



Complete Summary

GUIDELINE TITLE

ACR Appropriateness Criteria® right lower quadrant pain.

BIBLIOGRAPHIC SOURCE(S)

Bree RL, Rosen MP, Foley WD, Gay SB, Grant TH, Heiken JP, Huprich JE, Lalani T, Miller FH, Ros PR, Sudakoff GS, Greene FL, Rockey DC, Expert Panel on Gastrointestinal Imaging. ACR Appropriateness Criteria® right lower quadrant pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2007. 5 p. [35 references]

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Bree RL, Blackmore CC, Foley WD, Gay SB, Glick SN, Heiken JP, Huprich JE, Levine MS, Ros PR, Rosen MP, Shuman WP, Greene FL, Rockey DC, Expert Panel on Gastrointestinal Imaging. Right lower quadrant pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2005. 7 p. [43 references]

The appropriateness criteria are reviewed annually and updated by the panels as needed, depending on introduction of new and highly significant scientific evidence.

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SCOPE

DISEASE/CONDITION(S)

Right lower quadrant pain

GUIDELINE CATEGORY

Diagnosis

CLINICAL SPECIALTY

Emergency Medicine
Family Practice
Gastroenterology
Internal Medicine
Nuclear Medicine
Pediatrics
Radiology
Surgery

INTENDED USERS

Health Plans
Hospitals
Managed Care Organizations
Physicians
Utilization Management

GUIDELINE OBJECTIVE(S)

To evaluate the appropriateness of initial radiologic examinations for patients with right lower quadrant pain

TARGET POPULATION

Patients with right lower quadrant pain

INTERVENTIONS AND PRACTICES CONSIDERED

1. X-ray
 - Abdomen
 - Contrast enema
2. Ultrasound (US)
 - Right lower quadrant (RLQ), graded compression
 - Pelvis
3. Computed tomography (CT), abdomen and pelvis
 - Without contrast
 - With contrast (oral or rectal)
4. Nuclear medicine (NUC), technetium (Tc)-99m white blood cell (WBC) scan, abdomen and pelvis
5. Magnetic resonance imaging (MRI), abdomen and pelvis, with or without contrast

MAJOR OUTCOMES CONSIDERED

Utility of radiologic examinations in differential diagnosis

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The guideline developer performed literature searches of peer-reviewed medical journals, and the major applicable articles were identified and collected.

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Not Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not stated

METHODS USED TO ANALYZE THE EVIDENCE

Review of Published Meta-Analyses
Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

One or two topic leaders within a panel assume the responsibility of developing an evidence table for each clinical condition, based on analysis of the current literature. These tables serve as a basis for developing a narrative specific to each clinical condition.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus (Delphi)

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Since data available from existing scientific studies are usually insufficient for meta-analysis, broad-based consensus techniques are needed to reach agreement in the formulation of the appropriateness criteria. The American College of Radiology (ACR) Appropriateness Criteria panels use a modified Delphi technique to arrive at consensus. Serial surveys are conducted by distributing questionnaires to consolidate expert opinions within each panel. These questionnaires are distributed to the participants along with the evidence table and narrative as

developed by the topic leader(s). Questionnaires are completed by the participants in their own professional setting without influence of the other members. Voting is conducted using a scoring system from 1 to 9, indicating the least to the most appropriate imaging examination or therapeutic procedure. The survey results are collected, tabulated in anonymous fashion, and redistributed after each round. A maximum of three rounds is conducted and opinions are unified to the highest degree possible. Eighty percent agreement is considered a consensus. This modified Delphi technique enables individual, unbiased expression, is economical, easy to understand, and relatively simple to conduct.

If consensus cannot be reached by the Delphi technique, the panel is convened and group consensus techniques are utilized. The strengths and weaknesses of each test or procedure are discussed and consensus reached whenever possible. If "No consensus" appears in the rating column, reasons for this decision are added to the comment sections.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

ACR Appropriateness Criteria®

Clinical Condition: Right Lower Quadrant Pain

Variant 1: Fever, leukocytosis, and classic presentation clinically for appendicitis in adults.

Radiologic Procedure	Rating	Comments	RRL*
CT abdomen and	8	Use of oral or rectal contrast	High

Radiologic Procedure	Rating	Comments	RRL*
pelvis with contrast		depends on institutional preference.	
CT abdomen and pelvis without contrast	7	Use of oral or rectal contrast depends on institutional preference.	High
US abdomen RLQ	6	With graded compression	None
US pelvis	5		None
X-ray abdomen	5		Med
MRI abdomen and pelvis with or without contrast	4	See comments regarding contrast in the text under "Anticipated Exceptions."	None
X-ray contrast enema	3		Med
NUC Tc-99m WBC scan abdomen and pelvis	3		Med
<u>Rating Scale: 1=Least appropriate, 9=Most appropriate</u>			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Fever, leukocytosis; possible appendicitis, atypical presentation, adults and adolescents.

Radiologic Procedure	Rating	Comments	RRL*
CT abdomen and pelvis with contrast	8	Use of oral or rectal contrast depends on institutional preference.	High
X-ray abdomen	6		Med
US abdomen RLQ	6	With graded compression.	None
US pelvis	6		None
CT abdomen and pelvis without contrast	6	Use of oral or rectal contrast depends on institutional preference.	High
MRI abdomen and pelvis with or without contrast	5	See comments regarding contrast in the text below under "Anticipated Exceptions."	None

Radiologic Procedure	Rating	Comments	RRL*
X-ray contrast enema	3		Med
NUC Tc-99m WBC scan abdomen and pelvis	3		Med
<u>Rating Scale:</u> 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: Fever, leukocytosis, pregnant woman.

Radiologic Procedure	Rating	Comments	RRL*
US abdomen RLQ	8	With graded compression. Better in first and early second trimester.	None
MRI abdomen and pelvis without contrast	7		None
US pelvis	6		None
CT abdomen and pelvis with contrast	6	Use of oral or rectal contrast depends on institutional preference.	High
CT abdomen and pelvis without contrast	5	Use of oral or rectal contrast depends on institutional preference.	High
X-ray abdomen	2		Med
X-ray contrast enema	2		Med
NUC Tc-99m WBC scan abdomen and pelvis	2		Med
<u>Rating Scale:</u> 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 4: Fever, leukocytosis, possible appendicitis, atypical presentation in children (less than 14 years of age).

Radiologic Procedure	Rating	Comments	RRL*
US abdomen RLQ	8	With graded compression.	None
CT abdomen and pelvis with contrast	7	May be useful following negative US. Use of oral or rectal contrast depends on institutional preference. Consider limited RLQ CT.	High
X-ray abdomen	6		Med
US pelvis	5		None
CT abdomen and pelvis without contrast	5	Use of oral or rectal contrast depends on institutional preference. Consider limited RLQ CT.	High
MRI abdomen and pelvis with or without contrast	5	See comments regarding contrast in the text below under "Anticipated Exceptions."	None
X-ray contrast enema	3		High
NUC Tc-99m WBC scan abdomen and pelvis	2		Med
<u>Rating Scale:</u> 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Summary of Literature Review

Few comparative imaging studies evaluating right lower quadrant pain are available. Most imaging reports center on disease processes, such as appendicitis. Because appendicitis is the most common cause of right lower quadrant pain, the focus of this narrative is on appendicitis and the accuracy of imaging procedures in diagnosing appendicitis, although consideration of other diseases is, of course, included.

Acute appendicitis is the most common acute abdominal disorder that requires surgery. In most patients with acute appendicitis, imaging may not be necessary, because the clinical presentation is sufficiently diagnostic to allow surgery. To date, however, no prediction rules for identifying subjects with appendicitis have been validated. In the published studies for imaging in appendicitis, the selection

criteria for imaging are not often stated, but in most investigations, subjects with definitive clinical exam findings of appendicitis undergo operation without imaging. In the reported imaging studies, an average of 45% to 50% of imaged subjects had appendicitis, and 36% had nonspecific abdominal pain. Data on the overall effect of imaging on surgical treatment of appendicitis and patient outcome remain contradictory.

Radiographic diagnosis is of limited value for diagnosing acute appendicitis, except in occasional circumstances when an appendicolith or other ancillary findings are identified. Although barium enema has been used historically to diagnose appendicitis, it depends on the negative finding of nonvisualization of the appendix and may be quite uncomfortable in patients with acute appendicitis. Nonetheless, barium small-bowel follow-through or barium enema may be useful for other causes of right lower quadrant pain, including suspected small bowel obstruction, infectious ileitis, and inflammatory bowel disease. Finally, use of magnetic resonance imaging (MRI) for appendicitis has been reported in a few small case series, including in pregnant women.

Computed tomography (CT) is the most accurate study for evaluating patients without a clear clinical diagnosis of acute appendicitis. In a meta-analysis of prospective studies of the accuracy of CT and ultrasound (US) in adolescents and adults, CT demonstrated superior sensitivity (0.94, 95% confidence interval [CI]: 0.91 to 0.95) and specificity (0.95, 95% CI: 0.93 to 0.96) versus US (sensitivity 0.86, 95% CI: 0.83 to 0.88; specificity 0.81, 95% CI: 0.78 to 0.84). This analysis was based on studies of CT and US identified through December 2004, and included four studies that directly compared both modalities. The results of investigations of CT showed consistent results across all studies and institutions, while US investigations demonstrated heterogeneity, suggesting greater dependence on operator skill.

Another controversy is whether or not to use intravenous contrast in the CT evaluation of appendicitis. High accuracy has been reported for both techniques, and direct comparisons are lacking. However, the majority of the available evidence is on CT with intravenous contrast. Institutional experience may be the best determinant of appropriateness of intravenous contrast. More recently, emergency physicians and surgeons have suggested eliminating oral contrast from protocols for evaluating patients with suspected appendicitis in order to expedite evaluation and have a better preparation for surgery. There is as yet no proof that this protocol will have the same accuracy as those with oral contrast. A compromise position might be to use rectal contrast to opacify the bowel surrounding the appendix, particularly in thin patients. Both CT and US may be effective in detecting causes of pain unrelated to appendicitis. CT has been reported to show a non-appendicitis cause of abdominal pain in 20% of subjects, versus 15% for US. The range of diseases studied includes inflammatory bowel disease, infectious bowel disease, small bowel obstruction, acute gynecological conditions, and others.

CT appears superior to sonography in evaluating patients with periappendiceal abscess, especially when the abscesses become large. CT can be used to choose among different therapeutic options, including antibiotic treatment (with small abscesses), percutaneous drainage (with one to three well-defined medium-sized

abscesses), and surgery (with extensive abnormality not amenable to percutaneous drainage).

CT and US have been less well evaluated in children than in adults. Many large prospective studies include subjects of all ages, despite the potential differences in imaging accuracy between children and adults due to smaller body size and less body fat in children. This makes it difficult to determine the accuracy of imaging in different subgroups. Further, the increased radiosensitivity of children makes the use of ionizing radiation of more concern for them. A systematic literature review through July 2004 revealed eight prospective evaluations of US for appendicitis in children. The pooled sensitivity of graded compression US was 91% (95% CI: 89% to 93%), and the specificity was 97% (95% CI: 95% to 99%). Only a single prospective study of CT in children was identified, reporting a sensitivity of 95%, and specificity of 98%. There is also a small literature on the use of US as an initial imaging study, followed by CT for equivocal cases. Such combined protocols demonstrate a sensitivity of 95% (95% CI: 83% to 100%), and specificity of 93% (95% CI: 87% to 97%). These results suggest that although CT is more accurate, US may also be appropriate in experienced hands, particularly if equivocal results are followed up by CT.

Nuclear medicine imaging with WBC scans has also been reported for evaluating right lower quadrant pain.

Evaluation of the accuracy of imaging in pregnant women has received little attention in the literature. In general, ionizing radiation from CT should be avoided during pregnancy, and US is clearly a safer imaging option. In the appropriate clinical setting, MRI can be accurate in excluding appendicitis where the US exam does not visualize a normal appendix.

Anticipated Exceptions

Nephrogenic systemic fibrosis (NSF, also known as nephrogenic fibrosing dermopathy) was first identified in 1997 and has recently generated substantial concern among radiologists, referring doctors and lay people. Until the last few years, gadolinium-based MR contrast agents were widely believed to be almost universally well tolerated, extremely safe and non-nephrotoxic, even when used in patients with impaired renal function. All available experience suggests that these agents remain generally very safe, but recently some patients with renal failure who have been exposed to gadolinium contrast agents (the percentage is unclear) have developed NSF, a syndrome that can be fatal. Further studies are necessary to determine what the exact relationships are between gadolinium-containing contrast agents, their specific components and stoichiometry, patient renal function and NSF. Current theory links the development of NSF to the administration of relatively high doses (e.g., >0.2mM/kg) and to agents in which the gadolinium is least strongly chelated. The U.S. Food and Drug Administration (FDA) has recently issued a "black box" warning concerning these contrast agents (http://www.fda.gov/cder/drug/InfoSheets/HCP/gcca_200705HCP.pdf).

This warning recommends that, until further information is available, gadolinium contrast agents should not be administered to patients with either acute or significant chronic kidney disease (estimated glomerular filtration rate [GFR] <30 mL/min/1.73m²), recent liver or kidney transplant or hepato-renal syndrome,

unless a risk-benefit assessment suggests that the benefit of administration in the particular patient clearly outweighs the potential risk(s).

Abbreviations

- CT, computed tomography
- Med, medium
- MRI, magnetic resonance imaging
- NUC, nuclear medicine
- RLQ, right low quadrant
- Tc, technetium
- US, ultrasound
- WBC, white blood cell

Relative Radiation Level	Effective Dose Estimated Range
None	0
Minimal	<0.1 mSv
Low	0.1-1 mSv
Medium	1-10 mSv
High	10-100 mSv

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The recommendations are based on analysis of the current literature and expert panel consensus.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Selection of appropriate radiologic imaging procedures for evaluation of patients with acute right lower quadrant pain

POTENTIAL HARMS

- Barium enema may be quite uncomfortable in patients with acute appendicitis.

- In general, ionizing radiation from computed tomography (CT) should be avoided during pregnancy, and ultrasound (US) is clearly a safer imaging option.
- Recently some patients with renal failure who have been exposed to gadolinium contrast agents (the percentage is unclear) have developed nephrogenic systemic fibrosis (NSF), a syndrome that can be fatal. The U.S. Food and Drug Administration (FDA) has recently issued a "black box" warning concerning these contrast agents. This warning recommends that, until further information is available, gadolinium contrast agents should not be administered to patients with either acute or significant chronic kidney disease (estimated glomerular filtration rate [GFR] <30 mL/min/1.73m²), recent liver or kidney transplant or hepato-renal syndrome, unless a risk-benefit assessment suggests that the benefit of administration in the particular patient clearly outweighs the potential risk(s).

Relative Radiation Level (RRL)

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Additional information regarding radiation dose assessment for imaging examinations can be found in the American College of Radiology (ACR) Appropriateness Criteria® Radiation Dose Assessment Introduction document (see "Availability of Companion Documents" field).

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

An American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those exams generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Personal Digital Assistant (PDA) Downloads

For information about [availability](#), see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Bree RL, Rosen MP, Foley WD, Gay SB, Grant TH, Heiken JP, Huprich JE, Lalani T, Miller FH, Ros PR, Sudakoff GS, Greene FL, Rockey DC, Expert Panel on Gastrointestinal Imaging. ACR Appropriateness Criteria® right lower quadrant pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2007. 5 p. [35 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1996 (revised 2007)

GUIDELINE DEVELOPER(S)

American College of Radiology - Medical Specialty Society

SOURCE(S) OF FUNDING

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

GUIDELINE COMMITTEE

Committee on Appropriateness Criteria, Expert Panel on Gastrointestinal Imaging

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Panel Members: Robert L. Bree, MD, MHSA; Max Paul Rosen, MD, MPH; W. Dennis Foley, MD; Spencer B. Gay, MD; Thomas H. Grant, DO; Jay P. Heiken, MD; James E. Huprich, MD; Tasneem Lalani, MD; Frank H. Miller, MD; Pablo R. Ros, MD, MPH; Gary S. Sudakoff, MD; Frederick L. Greene, MD; Don C. Rockey, MD

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

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The appropriateness criteria are reviewed annually and updated by the panels as needed, depending on introduction of new and highly significant scientific evidence.

GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) from the [American College of Radiology \(ACR\) Web site](#).

ACR Appropriateness Criteria® *Anytime, Anywhere*™ (PDA application). Available from the [ACR Web site](#).

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

AVAILABILITY OF COMPANION DOCUMENTS

The following are available:

- ACR Appropriateness Criteria®. Background and development. Reston (VA): American College of Radiology; 2 p. Electronic copies: Available in Portable

Document Format (PDF) from the [American College of Radiology \(ACR\) Web site](#).

- ACR Appropriateness Criteria® radiation dose assessment introduction. American College of Radiology. 2 p. Electronic copies: Available from the [American College of Radiology Web site](#).

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on March 19, 2001. The information was verified by the guideline developer on March 29, 2001. This summary was updated by ECRI on March 24, 2006. This summary was updated by ECRI Institute on June 23, 2009.

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